



ANTUSD: A Large Chinese Sentiment Dictionary

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- Extended-HowNet (E-HowNet)

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- Features

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MOTIVATION

SENTIMENT DICTIONARY

- ▶ A building block of sentiment analysis & opinion mining
- ▶ Applied as markers or machine learning features

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AUGMENTED NTU SENTIMENT DICTIONARY (ANTUSD)

- ▶ Lack of Chinese resource
- ▶ Big & complete
- ▶ Expert labeled sentiment & machine predicted sentiment scores

RELATED CORPORA I

- Words and labels were collected from several sentiment corpora (2006~2010)



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WORD-BASE, CONTEXT FREE

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- ▶ ACIBiMA

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 - ▶ Labels: **POS** and **NEG** (2812/8276)
- ▶ ACIBiMA

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 - ▶ Labels: **POS**, **NEU**, **NEG**, **NONOP**, and **NOT**

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 - ▶ Labels: **POS**, **NEU**, **NEG**, **NONOP**, and **NOT**
 - ▶ **NONOP** indicates a non-emotion words
 - ▶ **NOT** indicates an incorrectly segmented word

RELATED CORPORA II

SENTENCE-BASED, CONTEXT DEPENDENT

- ▶ NTCIR Multilingual Opinion Analysis Test (MOAT) Dataset
- ▶ Chinese Opinion Tree Bank



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PROPERTIES

- ▶ Labels: **POS**, **NEU**, and **NEG**
- ▶ Label process: sentence → sentiment words
- ▶ Each word might belong to conflicting labels
- ▶ Context information not included in ANTUSD

MACHINE PREDICTED SENTIMENT SCORE

- ▶ CopeOpi: A Chinese opinion-analysis system
- ▶ Sentiment scores of documents, sentences, words, and characters
- ▶ Polarity score of each character is calculated statistically
- ▶ Word by summing up characters; sentence by summing up words...

EXTENDED-HOWNET (E-HOWNET)

E-HOWNET

- ▶ A frame-based entity-relation model extended from HowNet
- ▶ Define lexical senses (concepts) in a hierarchical manner
- ▶ Now integrated with ANTUSD and covers 47.7% words in ANTUSD



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詞彙:	致勝	Word
詞性:	VH11	Pos Tag
英文意涵:	win victory	English Meaning
概念式:	{win 獲勝}	Concept Frame
展開式:		
WordNet 自動連結:	WordNet Linkage {gain.v.05, succeed.v.01, acquire.v.05, win.v.01}	

Sentiment					
score	positive	neutral	negative	non_opinion	non_word
0.5772	1	0	0	0	0

DEMONSTRATIVE EXPERIMENT

EXPERIMENT SETTING

- ▶ Dataset: ANTUSD \cap E-hownet, a total 12995 words
- ▶ Classifier: support vector machine (SVM) with linear kernel
- ▶ Average over 10-fold validation scores



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THREE SENTIMENT ANALYSIS TASKS

- ▶ Opinion extraction: identify opinion words (**{POS,NEG}** v.s. **NONOP**)
- ▶ Polarity classification: classify opinion words (**POS** v.s. **NEG**)
- ▶ Combined tasks (**POS, NEG, NONOP**)

- ▶ $P = \frac{\text{correct}(\text{opinion}) \cap \text{correct}(\text{polarity})}{\text{proposed}(\text{opinion})}$

- ▶ $R = \frac{\text{correct}(\text{opinion}) \cap \text{correct}(\text{polarity})}{\text{gold}(\text{opinion})}$

- ▶ $F - \text{score} = \frac{2PR}{P+R}$

PREPROCESSING

EXTRACT SINGLE LABEL FOR EACH WORD

1. **NOT**: $\text{Count}(\text{Not}) > 0$
2. **NONOP**: $\text{Count}(\text{Non}) > 0$
3. **POS**: $\text{Count}(\text{Pos}) > 0$ and $\text{Count}(\text{Neg}) = 0$
4. **NEG**: $\text{Count}(\text{Neg}) > 0$ and $\text{Count}(\text{Pos}) = 0$
5. **NEU**: $\text{Count}(\text{Pos}) = 0$, $\text{Count}(\text{Neg}) = 0$ and $\text{Count}(\text{Neu}) > 0$

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4. **NEG**: $\text{Count(Neg)} > 0$ and $\text{Count(Pos)} = 0$
5. **NEU**: $\text{Count(Pos)} = 0$, $\text{Count(Neg)} = 0$ and $\text{Count(Neu)} > 0$

- ▶ Neutral words are dropped since there are only 16 of them
- ▶ Words not labeled are also dropped (e.g., $\text{Count(Pos)} > 0$ and $\text{Count(Neg)} > 0$)

FEATURES

ANTUSD & E-HOWNET

- ▶ CopeOpi score in ANTUSD
- ▶ Synonym-Set index (SSI)
 - ▶ Concept frame index of a word
 - ▶ Each word might belong to many concepts
 - ▶ Represented as a binary vector

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WORD EMBEDDING

- ▶ Corpus: LDC2009T14 (Chinese news)
- ▶ Word vectors
- ▶ Summation of char vectors

OPINION EXTRACTION

- ▶ COP, SSI has lower precision
 - ▶ opinion extraction is more semantic-oriented
 - ▶ Many words contain single SSI

Feature(s)	Precision	Recall	f-score
COP	0.686	1.000	0.814
SSI	0.693	0.993	0.816
WV	0.784	0.936	0.854
CV	0.765	0.919	0.835
COP+SSI	0.740	0.914	0.818
COP+WV	0.785	0.933	0.853
COP+CV	0.764	0.917	0.833
SSI+WV	0.789	0.937	0.856
SSI+CV	0.772	0.920	0.840
WV+CV	0.808	0.921	0.861

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- ▶ Features are complemented; combined features leads to improvement

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POLARITY CLASSIFICATION

- COP leads to a significant better result, reflecting is sentiment-oriented nature

Feature(s)	POS f1	NEG f1	Average f1
COP	0.973	0.976	0.974
SSI	0.792	0.842	0.817
WV	0.870	0.895	0.882
CV	0.829	0.851	0.840
COP+SSI	0.979	0.982	0.980
COP+WV	0.981	0.984	0.982
COP+CV	0.967	0.972	0.970
SSI+WV	0.898	0.915	0.907
SSI+CV	0.868	0.886	0.877
WV+CV	0.899	0.916	0.908

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POLARITY CLASSIFICATION

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- ▶ Combining word vectors and SSI also leads to improvement

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COMBINED TASK

- ▶ COP outperforms the others

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SSI	0.706	0.679	0.692
WV	0.737	0.767	0.752
CV	0.689	0.721	0.705
COP+SSI	0.864	0.945	0.903
COP+WV	0.850	0.902	0.875
COP+CV	0.840	0.869	0.854
SSI+WV	0.764	0.796	0.779
SSI+CV	0.732	0.755	0.743
WV+CV	0.764	0.813	0.787

COMBINED TASK

- ▶ COP outperforms the others
- ▶ Both the numerator of precision and recall are affected by COP's better polarity classification ability
- ▶ Only the denominator of precision is affected by COP's worse opinion extraction ability

PRECISION & RECALL

$$P = \frac{\text{correct}(\text{opinion}) \cap \text{correct}(\text{polarity})}{\text{proposed}(\text{opinio} \cap \text{opinion})}$$

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- ▶ WV+CV outperforms WV due to coverage issue

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CONCLUSION

- ▶ A so far the largest Chinese sentiment dictionary
- ▶ Manually sentiment labels & machine estimated sentiment scores
- ▶ Three experiments were conducted to demonstrate the usage of ANTUSD

Q & A

